

WHAT IS CLAIMED IS:

1. An isolated and purified polynucleotide that encodes a yeast phenylalanine ammonia lyase polypeptide comprising the sequence of SEQ ID NO:13.

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2. An isolated and purified polynucleotide that encodes a yeast phenylalanine ammonia lyase polypeptide comprising the sequence of SEQ ID NO:21.

3. An isolated and purified yeast phenylalanine ammonia lyase polynucleotide  
10 that encodes a yeast phenylalanine ammonia lyase polypeptide, wherein said  
polypeptide is at least 90% identical with SEQ ID NO:13.

4. An isolated and purified yeast phenylalanine ammonia lyase polynucleotide  
comprising a sequence selected from the group of sequences consisting of residues 1  
15 to 2589 of SEQ ID NO:28, residues 1 to 361 of SEQ ID NO:28, residues 449 to 880  
of SEQ ID NO:28, residues 961 to 1295 of SEQ ID NO:28, residues 1365 to 1529 of  
SEQ ID NO:28, residues 1587 to 1748 of SEQ ID NO:28, residues 1822 to 1947 of  
SEQ ID NO:28, residues 2008 to 2589 of SEQ ID NO:28, and residues 2008 to 2586  
of SEQ ID NO:28.

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5. An isolated and purified yeast phenylalanine ammonia lyase polynucleotide  
comprising the sequence of SEQ ID NO:20.

6. An isolated and purified yeast phenylalanine ammonia lyase polynucleotide  
25 comprising the sequence of SEQ ID NO:20, wherein

residues 117, 135, 190, 191, 195, 276, 1196 to 1198, 1724 to 1735, 1880,  
1881, and 2187 to 2475 are absent,

residues 13, 34, 46, 115, 164, 251, 266, 315, 330, 333, 340, 348, 423, 450,  
456, 468, 555, 570, 675, 681, 716, 723, 783, 921, 1176, 1380, 1383, 1407, 1446,  
30 1449, 1452, 1488, 1542, 1554, 1563, 1617, 1677, 1683, 1776, 1872, 1895, 1950,  
1971, and 1976 are B,

residues 49, 119, 331, 463, 715, 1270, 1684, 1708, 1762, 1768, 2001, 2145, and 2183 are D,

residues 59, 73, 102, 145, 233, 264, 357, 483, 758, 1042, 1241, 1470, 1509, 1690, 1745, 1962, and 2151 are H,

5 residues 51, 57, 144, 168, 201, 312, 405, 475, 963, 1043, 1281, 1308, 1675, 1678, 1681, 1693, 1952, and 2146 are V,

residues 79, 729, 1710, and 1873 are Y,

residues 84, 199, and 1723 are W,

residues 82, 200, 732, and 744 are S,

10 residues 106, 108, 284, and 743 are M,

residue 730 is K,

residues 76 and 77 are A,

residues 68, 75, 1855, 1857, 1858, 1860, 1862, and 1874 are C, and

residues 69, 1856, 1859, 1861, 1875 are T.

15 7. An isolated and purified yeast phenylalanine ammonia lyase polynucleotide comprising the sequence of SEQ ID NO:29.

8. An isolated and purified yeast polynucleotide that encodes phenylalanine ammonia lyase, wherein said polynucleotide is at least 80% identical with a sequence selected from the group of sequences consisting of residues 1 to 2589 of SEQ ID NO:28, residues 1 to 361 of SEQ ID NO:28, residues 449 to 880 of SEQ ID NO:28, residues 961 to 1295 of SEQ ID NO:28, residues 1365 to 1529 of SEQ ID NO:28, residues 1587 to 1748 of SEQ ID NO:28, residues 1822 to 1947 of SEQ ID NO:28, 20 residues 2008 to 2589 of SEQ ID NO:28, and residues 2008 to 2586 of SEQ ID NO:28.

25 9. An isolated and purified yeast polynucleotide that encodes phenylalanine ammonia lyase and specifically hybridizes under high stringency conditions to a sequence selected from the group of sequences consisting of residues 1 to 2589 of SEQ ID NO:28, residues 1 to 361 of SEQ ID NO:28, residues 449 to 880 of SEQ ID

NO:28, residues 961 to 1295 of SEQ ID NO:28, residues 1365 to 1529 of SEQ ID NO:28, residues 1587 to 1748 of SEQ ID NO:28, residues 1822 to 1947 of SEQ ID NO:28, residues 2008 to 2589 of SEQ ID NO:28, and residues 2008 to 2586 of SEQ ID NO:28, and said high stringency conditions comprise hybridization in 50%  
5 formamide, 5X SSC, at 42°C overnight, and washing in 0.5X SSC and 0.1% SDS, at 50°C.

10. An isolated and purified yeast polynucleotide that encodes a yeast phenylalanine ammonia lyase polypeptide, wherein said polynucleotide is obtained  
10 from strain ATCC PTA-2224.

11. An isolated and purified polynucleotide encoding a yeast phenylalanine ammonia lyase polypeptide that comprises the sequence of SEQ ID NO:13 but is N-terminally truncated by the absence of one or more of amino acids 1 through 6 of SEQ  
15 ID NO: 13.

12. An isolated and purified polynucleotide encoding a yeast phenylalanine ammonia lyase polypeptide that comprises the sequence of SEQ ID NO:13 but is C-terminally truncated by the absence of one or more of amino acids 715 through 720 of  
20 SEQ ID NO: 13.

13. An isolated and purified yeast phenylalanine ammonia lyase polynucleotide comprising residues 37 to 2196 of SEQ ID NO:12.

25 14. An isolated and purified yeast polynucleotide that encodes phenylalanine ammonia lyase, wherein said polynucleotide is at least 80% identical with residues 37 to 2196 of SEQ ID NO:12.

30 15. An isolated and purified yeast polynucleotide that encodes phenylalanine ammonia lyase and specifically hybridizes under high stringency conditions to residues 37 to 2196 of SEQ ID NO:12, and said high stringency conditions comprise

hybridization in 50% formamide, 5X SSC, at 42°C overnight, and washing in 0.5X SSC and 0.1% SDS, at 50°C.

16. An isolated and purified yeast polynucleotide that encodes phenylalanine  
5 ammonia lyase, wherein said polynucleotide is at least 90% identical with a sequence  
selected from the group of sequences consisting of residues 1 to 2589 of SEQ ID  
NO:28, residues 1 to 361 of SEQ ID NO:28, residues 449 to 880 of SEQ ID NO:28,  
residues 961 to 1295 of SEQ ID NO:28, residues 1365 to 1529 of SEQ ID NO:28,  
residues 1587 to 1748 of SEQ ID NO:28, residues 1822 to 1947 of SEQ ID NO:28,  
10 residues 2008 to 2589 of SEQ ID NO:28, and residues 2008 to 2586 of SEQ ID  
NO:28.

17. An isolated and purified yeast polynucleotide that encodes phenylalanine  
ammonia lyase, wherein said polynucleotide is at least 90% identical with residues 37  
15 to 2196 of SEQ ID NO:12.

18. An isolated and purified yeast polynucleotide that encodes phenylalanine  
ammonia lyase, wherein said polynucleotide is at least 95% identical with a sequence  
selected from the group of sequences consisting of residues 1 to 2589 of SEQ ID  
ID NO:28, residues 1 to 361 of SEQ ID NO:28, residues 449 to 880 of SEQ ID NO:28,  
residues 961 to 1295 of SEQ ID NO:28, residues 1365 to 1529 of SEQ ID NO:28,  
residues 1587 to 1748 of SEQ ID NO:28, residues 1822 to 1947 of SEQ ID NO:28,  
residues 2008 to 2589 of SEQ ID NO:28, and residues 2008 to 2586 of SEQ ID  
NO:28.

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19. An isolated and purified yeast polynucleotide that encodes phenylalanine  
ammonia lyase, wherein said polynucleotide is at least 95% identical with residues 37  
to 2196 of SEQ ID NO:12.

30 20. A construct that comprises a phenylalanine ammonia lyase polynucleotide  
according to claim 1.

21. A host cell that comprises the construct of claim 20.

22. A construct that comprises a phenylalanine ammonia lyase polynucleotide  
5 according to claim 4.

23. A host cell that comprises the construct of claim 22.

24. A construct that comprises a phenylalanine ammonia lyase polynucleotide  
10 according to claim 13.

25. A host cell that comprises the construct of claim 24.

26. An isolated and purified yeast phenylalanine ammonia lyase polypeptide  
15 comprising the sequence of SEQ ID NO:13 or SEQ ID NO:21.

27. A composition that comprises a phenylalanine ammonia lyase polypeptide  
according to claim 26.

28. A method of obtaining an isolated and purified phenylalanine ammonia  
lyase polypeptide, said method comprising the steps of:  
20 (a) growing the host cell according to claim 21 under conditions where the  
polypeptide is produced; and  
(b) isolating the polypeptide from the host cell or the medium in which the  
host cell is grown.  
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29. A method for the production of L-phenylalanine, said method comprising  
adding the host cell of claim 21 to a composition comprising *trans*-cinnamic acid, or  
*trans*-cinnamate and ammonia.  
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30. In an improvement of a method for producing phenylalanine, a phenylalanine analog, or another optically active unnatural amino acid having a phenylalanine-like structure, said improvement comprising the use of the host cell of claim 21 rather than another production host for phenylalanine ammonia lyase 5 polypeptide.

31. A method for the production of L-phenylalanine, said method comprising adding an isolated and purified phenylalanine ammonia lyase polypeptide according to claim 26 to a composition comprising *trans*-cinnamic acid, or *trans*-cinnamate and 10 ammonia.

32. In an improvement of a method for producing phenylalanine, a phenylalanine analog, or another optically active unnatural amino acid having a phenylalanine-like structure, said improvement comprising the use of the an isolated 15 and purified phenylalanine ammonia lyase polypeptide according to claim 26 rather than using another phenylalanine ammonia lyase polypeptide.

33. A method of treating a mammal having a disease, disorder, or condition that would benefit from treatment with a phenylalanine ammonia lyase polypeptide, 20 said method comprising administering to said mammal a construct according to claim 20.

34. The method of claim 33, wherein said disease, disorder, or condition is selected from the group consisting of phenylketonuria, cancer, human 25 immunodeficiency virus infection, and human cytomegalovirus infection.

35. A method of treating a mammal having a disease, disorder, or condition that would benefit from treatment with a phenylalanine ammonia lyase polypeptide, said method comprising administering to said mammal a phenylalanine ammonia 30 lyase polypeptide according to claim 26.

36. The method of claim 35, wherein said disease, disorder, or condition is selected from the group consisting of phenylketonuria, cancer, human immunodeficiency virus infection, and human cytomegalovirus infection.